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REMARKS

Currently, claims 1 and 3-27 are pending. Claim 2 was canceled in this Amendment and incorporated into independent claim 1. Claims 14-24 have been withdrawn as a result of the election in response to the Restriction Requirement.

Claims 1 and 2 were rejected under 35 U.S.C. §102(b) as allegedly being anticipated by German Patent 19848172. Claims 1-6 were rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over German Patent No. 19848172 in view of United States Patent No. 5,454,061 to Carlson and DuPont's Hytrel® Thermoplastic Polyester Elastomer. Claim 2 has been incorporated into claim 1 and claim 2 has been canceled. Reconsideration and withdrawal of these rejections is requested.

Applicants have obtained a translation of German Patent 19848172 and submit same herewith for the Examiner's consideration. German Patent 19848172 discloses methods of encapsulating or embedding solid reinforcing elements (particularly metal wire) into a joint between overlapping layers of spirally wound conduit. The resulting conduit's lateral reinforcement against crushing is provided by the metal wire, while the molten plastic filler material embeds the wire into the joint preventing it from coming loose when subjected to mechanical stresses (paragraph [0019]).

As such, the plastic "filler material" fills the voids created as the overlapping layer is supported away from the under lapping layer (either side of the wire), by its own stiffness. In order to prevent the molten plastic filler from escaping out, the longitudinal edge sections of the conduit must be subjected to pressure by rollers 19, 20.

The method of the present application does not teach wire reinforcement against lateral

crushing, as the molten bead of the present invention forms a helical reinforcing rib when it cools. Further, the very thin film ribbon described in the present invention is sufficiently supple (at least laterally) to conform along its overlapping portion to the contour of the soft molten bead.

Amended claim specifically require that the overlapping portion of the thin film conforms to the contour of the molten bead. In contrast, the conduit and method of producing the same described in German Patent 19848172 discloses a method where the overlapping portion does not conform to the contour of the bead. Rather, the reverse is true in German Patent 19848172. The molten plastic filler material conforms to the shape of the overlapping plastic strip and fills the voids created by the overlapping layers inability to conform to the contour of the wire reinforcement.

Applicants submit that the claimed method of claim 1 is clearly distinguished from German Patent 19848172. In particular, Applicants note that without the presence of the solid reinforcing wire taught by German Patent 19848172, the molten filler material would be flattened by the pressure of the overlapping layer. As a result, the majority of the molten material would squeeze out from the joint, creating at best an unacceptably rough inner conduit surface, and at worst, sticking to the mandrel and making the forming process impossible. German Patent 19848172 acknowledges this problem and teaches the need for pressure rollers to combat this effect.

Applicants submit that it is clear from the disclosure of German Patent 19848172 that the overlapping layer is not sufficiently supple to conform to the contour of the molten bead and does not therefore anticipate amended claim 1. The addition of Carlson and/or DuPont's Hytrel® Thermoplastic Polyester Elastomer do not resolve this deficiency of German Patent 19848172.

Further, Applicants submit that a person skilled in the relevant art at the priority date of the present application, would recognize that German Patent 19848172 and other similar methods know in the art, teach away from a supple thin film which conforms to the contour of a molten bead. Such prior art documents disclose and teach reinforcing a spirally wound conduit with a solid reinforcing wire and filling the resulting gaps with a filler material in order to prevent it from coming loose when subjected to mechanical stresses as described in paragraph [0019] of German Patent 19848172.

Therefore, Applicants submit that German Patent 19848172 does not anticipate amended claim 1 and German Patent 19848172 in view of Carlson and DuPont's Hytrel® Thermoplastic Polyester Elastomer does not render obvious amended claim 1. Reconsideration and allowance of amended claim 1 is requested.

Claims 7-9 were rejected under 35 U.S.C. 103 as allegedly being unpatentable over German Patent No. 19848172 in view of Carlson, DuPont's Hytrel® Thermoplastic Polyester Elastomer and United States Patent No. 2,748,830 to Nash et al. Claims 10-13 were rejected under 35 U.S.C. 103 as allegedly being unpatentable over Nash et al. in view of United States Patent No. 2,250,430 to Wade. Claims 10-13 and 25-27 were rejected under 35 U.S.C. § 103 as allegedly being unpatentable over German Patent No. 19848172 in view of Carlson, DuPont's Hytrel® Thermoplastic Polyester Elastomer, Nash et al. and Wade. Reconsideration and withdrawal of these rejections is requested.

In each of these rejections, the Examiner relies upon Nash to disclose the "sacrificial layer" claimed in the claims. The claims require that the "sacrificial layer" be *applied to the former*. In Nash, the only layer applied directly to the former as the claims require, is a cardboard

layer.

In addition, claim 10 requires the step of "welding said overlapping layers to each other". This cardboard layer is not welded to itself as required by claim 10.

Further, Nash discloses a method of forming conduit on a *stationary* mandrel (i.e. former) 4, see Col. 2, line 12. In contrast, the claims require that the former both *advance* and *rotate* the conduit.

Applicants submit that the claims are not rendered obvious by Nash in combination with the cited references, and that a person skilled in the art at the priority date of the present application, would not turn to Nash in order to solve a problem relating to forming conduit on a *rotating* mandrel, because the conduit forming method of Nash does not describe a rotating mandrel. Even if a person skilled in the art did turn to Nash, such person would be taught to apply a cardboard layer directly to the mandrel.

With further regard to claim 10, the Examiner appears to states that the cellophane layer of Nash applied over the cardboard (not directly to the mandrel), would be welded by the subsequent heating step and cites Wade to support this assertion.

On page 2, Col. 2, lines 65 through page 3, Col. 1, line 7, Wade lists several materials as examples of suitable sheet or film material. One of those materials listed is regenerated cellulose, i.e. cellophane. However, the very same list begins with "paper" which clearly is not a material that lends itself to welding. From line 73, Wade specifies:

> "These materials preferably are formed in whole or in part and/or combined with a *heat-fusible* material. The expression "heat-sealable" used in the description and claims is intended to apply to material which is inherently heat-fusible, i.e. a material such as

cellulose acetate, as well as material which is rendered heat-sealable by reason of being treated with an adhesive solvent and/or softening agent or which has been coated with a heat fusible composition." (emphasis added).

Applicants submit that it cannot be concluded from the disclosure of Wade if cellophane is inherently heat-fusible or whether a coating or treatment is required to render it heat fusible. Wade only teaches that cellulose acetate, not cellophane, is inherently heat fusible.

With regard to Nash, Col. 2, lines 21-24 discloses that "Supported upon the shafts 10 of each of the roll stands 7 are rolls of a parting material, such as *plain or unlacquered* cellophane tape 11." (emphasis added). Therefore, Applicants contend that Nash teaches plain or unlacquered cellophane, but it is not clear from Wade that such plain or unlacquered cellophane is heat-sealable as the Examiner suggests.

From Applicants' own research, Applicants have been unable to find any suggestion that plain cellophane is "heat sealable". Applicants enclose an Amcor document (dated 2004, this application has a U.S. filing date of 2003) relating to flexible packing. At the bottom of page 1 of the Amcor document, two products are indicated as "based on regenerated cellulose (cellophane)", and the following description appears:

> "Cellophane is the oldest clear flexible packaging material, first commercially produced in the 1930's. It is derived from wood pulp from which cellulose is extracted and cast into clear film. When coated with biodegradable polyester coatings, it forms a heatsealable, compostable film"

In conclusion, Applicants submit that it would not have been obvious to a person skilled in the relevant art from Nash in view of Wade, to apply a weldable layer directly to a mandrel

that rotates and advances the conduit. Nor is it obvious from Nash in a view of Wade that the cellophane layer of Nash would in fact have fused during heating.

Therefore, Applicants submit that claims are not rendered obvious by Nash in combination with the cited references. Reconsideration and allowance of same is requested.

In addition, claims 7-9 are dependent upon claim 1 which Applicants submit is allowable. Therefore, Applicants submit that claims 7-9 are allowable. Reconsideration and allowance of claims 7-9 is requested.

A Petition for a Two-Month Extension of Time is concurrently submitted herewith to extend the date for response up to and including August 21, 2006 (August 20, 2006 having fallen on a Sunday).

In view of the above, Applicants respectfully submit that the claims of the application are allowable over the rejections of the Examiner. Should the Examiner have any questions regarding this Amendment, the Examiner is invited to contact one of the undersigned attorneys at (312) 704-1890.

Respectfully submitted,

Date: Aug. 21, 2006

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SUSTAINABILITY REPORT 2004
Our major products – Flexible packaging

Case Study
Amcor Flexibles

AMCOR

Amcor Flexibles is a market leader in flexible packaging.

A market leader must deliver value to its customers. For Amcor Flexibles, this means delivering innovation, customer service excellence and cost effective high quality products through close customer relationships. Our objective is to manufacture these products in environmentally compliant, safe, clean and efficient factories.

As a market leader, Amcor Flexibles uses a broad skill base and comprehensive range of technological capabilities that is second to none in flexibles and this is backed by significant group resources as part of Amcor – one of the world's largest packaging companies.

Concern for the environment together with increased legislation has prompted retailers, packers and packaging manufacturers to question the environmental impact of flexible packaging systems.

This information is provided to help demonstrate some areas where Amcor Flexibles is working to manufacture innovative new products which still meet the differing needs of our many stakeholders, but also have less impact on our environment.

Amcor Flexibles has recently developed some exciting, new products for the Fresh Produce sector, which are compostable.

Biodegradable and Compostable Films

Amcor Flexibles can supply two different materials that are fully biodegradable and compostable for use with Fresh Produce.

These are:

30 DA - based on Poly Lactic Acid (PLA)

PLA is suitable for a wide range of MAP chilled and ambient fresh produce applications such as VFFS root vegetable packs, pre-made bags for prepared vegetables, HFFS punnet overwrapping and VFFS prepared salads. It has excellent clarity and stiffness although it is rather noisy to handle.

Amcor Flexibles has the approval to print the *Compostable* logo on this film.

23 and 30 QB – based on regenerated cellulose (cellophane)

Cellophane is the oldest clear flexible packaging material, first commercially produced in the 1930's. It is derived from wood pulp from which cellulose is extracted and cast into clear film. When coated with biodegradable polyester coatings, it forms a heatsealable, compostable film.

compostable

SUSTAINABILITY REPORT 200
Our major products – Flexible packaging

Case Study
Amcor Flexibles

AMCOR

Attributes	30 DA – PLA	23 QB – Cellophane
Made From:	Corn Starch, currently GM crop from USA*	Wood pulp
Material Type:	PLA	Cellophane
Clarity:	Excellent	Excellent
Stiffness:	Excellent	Excellent (when dry)
Resistance to water:	Excellent- Totally un-affected	Poor- Seals weaken, Film becomes limp and wrinkled
Suitable for Viking Hot Needle Perforation:	Yes but reduces maximum pack weight	Yes but recommend flow wrap over punnet
Suitable for P-Plus perforation:	Yes	No
Suitable for Viking Punched Holes:	Yes	Yes
Printable:	Yes	Yes
Lidding:	Weld seal to PLA tray	Peel seal to PVC, aPET or PLA trays
Suitability for Microwave:	No; film melts around 95°C	Legislatively OK for microwave use for produce, but seals soften

Although PLA is currently made from GM corn, no trace of GMO is present in the finished PLA packaging film. However, if the end user prefers to support non-GM corn sourcing, a source offset plan is available. For a price premium, it is possible to certify that non-GM feedstock will be purchased to produce an equivalent quantity of PLA resin. However, it is not possible to certify that the actual PLA film purchased will be made from non-GM feedstock

Aldridge & Co Ltd
Patent, Legal, and Technical Translators - Wellington, NZ

Translation from German

DE 198 48 172 C2

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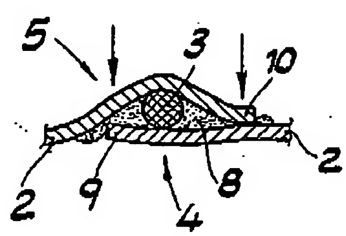
Application for non-disclosure

(56) Documents taken into account in assessing patentability:

DE 197 07 407 A1
DE 297 10 123 U1
US 35 63 826
US 33 36 172
US 32 19 738
US 25 39 853

(54) **Method of Producing a Spirally-wound Hose Made of Thermoplastic Material**

(57) A method for producing a spirally-wound hose from thermoplastic material,
in which at least one plastic strip with a reinforcement is continuously wound spirally to form a spirally-wound hose,
during which, longitudinal edge sections of adjacent turns of the plastic strip are bonded overlappingly to each other,
characterised in that
□ the longitudinal edge sections are welded firmly to each other by introducing a molten plastic-filler material between mutually-facing longitudinal edge sections;
□ the reinforcement gets affixed to the plastic strip by means of the molten plastic-filler material, and/or the reinforcement used has already been encapsulated in the plastic material of the plastic strip beforehand; and
□ after the introduction of the molten plastic filler-material, the two opposite end regions of the overlapping longitudinal edge sections are subjected to pressure by pressure rollers, to prevent the molten filler from escaping.



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Translation from German

DE 198 48 172 C2

Method of Producing a Spirally-wound Hose Made of Thermoplastic Material

Description

[0001] The invention relates to a method for producing a spirally-wound hose from thermoplastic material, in which at least one plastic strip with a reinforcement is continuously wound in a spiral, to form a spirally-wound hose; during which process, longitudinal edge sections of adjacent turns of the plastic strip are bonded overlappingly to each other. Preferably only one plastic strip is fed in and wound spirally to produce the hose, with the plastic-strip segments of adjacent turns being bonded to each other overlappingly on longitudinal edge sections thereof. However, it is also in principle possible, according to the invention, to feed in two or more plastic strips, and wind them spirally to form the hose. The reinforcement is wound spirally, together with the plastic strip; and therefore, in the finished hose, the reinforcement runs in the (spirally-wound) plastic strip's longitudinal direction.

[0002] A spirally-wound hose produced by a method of the type mentioned initially is disclosed by DE 297 10 123 U1. In this case, the plastic strip consists entirely of a weldable plastic material or a fabric strip coated with a weldable plastic material. The plastic material of the longitudinal edge sections is suitably heated, to soften it, and the overlapping edge sections are adhesively bonded to each other. The heating is normally not performed in a focused manner, however. In practice, hot air is blown into the spiral winding of the plastic strip, causing the plastic material of the overlapping longitudinal edge sections to soften and become adhesively bonded to each other. This known method has a number of drawbacks. For example, the mechanical strength of the bonds produced, in the

manner described, between the longitudinal edge sections of adjacent turns leaves something to be desired. If, as in one form of embodiment of this prior-art method, a reinforcement (for instance, a metal wire) is embedded, by melting, between the longitudinal edge sections, then any mechanical stress placed on the spirally-wound hose can cause the reinforcement to be relatively easily detached from the plastic bond, as a result of which, adequate mechanical stability of the spirally-wound hose is no longer ensured. Moreover, the spirally-wound hose produced by the known method has a relatively uneven, i.e. not very smooth, inner surface. That is particularly the case when a reinforcement has been embedded, by melting, between the longitudinal edge sections. It will be readily understood that this will hinder transportation of substances through the spirally-wound hose. Furthermore, the introduction of hot air into the spiral winding, as required with this known method, is relatively energy-demanding and therefore costly. Besides this, the speed of production leaves something to be desired.

[0003] US 33 36 172 also discloses a method for producing a spirally-wound hose made of plastic. In this method too, plastic strips are wound spirally to form a hose. These plastic strips have an adhesive coating on them, to produce the bonds between the plastic strips. However, the spirally-wound hose produced by means of the adhesive coatings can cope with little mechanical stress. When subjected to much mechanical stress, the bonds between the plastic strips tear apart. Nor can effective attachment or encapsulation of the reinforcement be achieved with this known method.

[0004] A method for producing spirally-wound plastic hoses with a reinforcement is also disclosed by US 25 39 853. During the production of this spirally-wound hose, mutually-overlapping layers are subjected to pressure, for improved bonding.

[0005] DE 197 07 407 A1 discloses a device for producing a tubelet, in particular a drinking straw. To produce the tubelet, a material in the form of a band consisting of coated paper for example, is wound in a spiral. No reinforcement is provided. An adhesive bond is provided in the overlap region of the band-material. The adhesive bond can be produced by a gluing device which supplies energy to the overlap region of the coated band-material. The tubelet produced in this manner cannot cope with much mechanical stress.

[0006] In addition, US 3 563 826 discloses the production of a cylindrical container with a double-layered wall, i.e. a wall consisting of two layers of plastic arranged one over the other. The plastic sheets fed together for this purpose are bonded to each other by means of a layer of heat-seal.

[0007] Moreover, the welding of thick-walled plastic parts by means of manual extruders is known in practice. (The thick-walled container parts concerned can be e.g. rubbish-dump lining sheets, or pipe connections.) This practice involves feeding a plastic welding filler-material, in the form of a plastic welding-rod, to the manual extruder. This rod is melted in the manual extruder, and is fed in plasticised form to the plastic parts that are to be bonded together. By means of welding-shoes of special design, large-volume weld seams are then produced—by means of the plasticised plastic material—between the thick-walled plastic parts that are to be bonded. With a welding-shoe applied, the plasticised plastic is formed to the geometry of the required welding-seam. With this method, the regions of the plastic parts that are to be bonded have to be preheated. In this regard, it is also known in the art that, when welding rubbish-dump lining sheets, sections of sheet can be overlapped and then have a welded bead applied to the overlap. However, these known measures are unsuitable for welding thin plastic strips or thin plastic sheets, particularly when producing spirally-wound hoses.

[0008] The object of the invention is to provide a method of the type mentioned initially, whereby spirally-wound hoses with a reinforcement can be produced in a simple manner, but with a firm, long-lasting bond between the overlapping longitudinal edge sections.

[0009] To achieve this object, the invention teaches a method of the type mentioned initially, which is characterised in that the longitudinal edge sections are welded firmly to each other by introducing a molten plastic-filler material between mutually-facing longitudinal edge sections; the reinforcement gets fixed to the plastic strip by means of the molten plastic filler-material, and/or the reinforcement is encapsulated in the plastic material of the plastic strip beforehand; and after the introduction of the molten plastic filler-material, the two opposite end regions of the overlapping longitudinal edge sections are subjected to pressure by pressure rollers, to prevent molten plastic filler from getting out.

[0010] According to the invention, the thickness of the plastic strip is small compared with the diameter of the spirally-wound hose that is to be produced, and therefore the wall-thickness of the spirally-wound hose is also small relative to the hose's diameter. In one form of embodiment of the invention, the plastic strip is a strip of thermoplastic sheet. Is another form of embodiment, it is a band of thermoplastic fabric.

[0011] The plastic strip can also be a band of fabric coated with a thermoplastic.

[0012] According to the invention, a welding filler-material consisting of a molten thermoplastic is introduced between the longitudinal edge sections of the plastic strip, and these longitudinal edge sections are welded firmly to each other, overlappingly, by means of this molten plastic filler-material. During this spiral winding of the plastic strip, it is appropriate to apply the molten plastic filler material to a first longitudinal edge section, and then, immediately thereafter, to apply or press the second longitudinal edge section onto the first longitudinal edge section and the molten plastic filler.

[0013] In one form of embodiment of invention, the plastic filler consists of a thermoplastic material that is the same as that of the plastic strip. In another form of embodiment, the plastic filler can consist of a different thermoplastic material from that of the plastic strip. According to the invention, the plastic filler can consist of a polyalkene (for instance, polyethylene), or a polyurethane.

[0014] In a preferred form of implementation of the inventive method, a welding extruder is used, from which the molten plastic filler is supplied. Preferably, ordinary plastic granulate is melted in the welding extruder, and supplied in the form of a molten filler, through at least one extrusion die, to the longitudinal edge sections that are to be bonded. According to the invention, no preheating of the longitudinal edge sections that are to be bonded is required, and nor do they require any other special treatment-measures. In contrast to the initially-described, known ways of welding thick-walled plastic parts, no special welding-shoe is required for producing the inventive weld seam.

[0015] In a preferred form of embodiment the invention, the molten plastic filler is introduced in the form of a thin film and/or at least one thin thread, to form a thin weld seam between the longitudinal edge sections, thus preventing the

molten plastic filler, or at least larger amounts thereof, from escaping form the overlap region of the longitudinal edge sections. According to the invention, after the introduction of molten plastic filler, the end regions of the overlapping longitudinal edge sections are subjected to pressure, to prevent any escape of molten plastic filler. The pressure is applied on the two opposite end regions of the overlapping longitudinal edge sections, by means of pressure rollers in a pressure roller arrangement. Preferably, each of the two opposite end regions of the overlapping longitudinal edge sections has a pressure roller assigned to it. According to the invention, first the molten plastic filler is introduced between the two mutually-facing longitudinal edge sections. Then pressure is applied with pressure rollers. Preferably, during the continuous spiral winding of the plastic strip, molten plastic filler is applied to a longitudinal edge section thereof, at a first station; and then, after the mutually-facing longitudinal edge sections are overlapped with each other, pressure is applied in a second, downstream, station. The application of pressure according to the invention makes it possible to control the distribution of the molten plastic filler effectively and, above all, to prevent the molten plastic filler from getting smeared onto other regions of the plastic strip. Preferably, according to the invention, the amount of pressure to be applied can be set definably.

[0016] In a preferred form of embodiment that is particularly important in terms of the invention, the reinforcement is introduced between the longitudinal edge sections, and is weldingly embedded between the overlapping longitudinal edge sections by means of the plastic filler. In this form of embodiment, the reinforcement is thus, as it were, integrated into the weld seam. The reinforcement is preferably a metal wire and/or a plastic monofilament. According to the invention, the reinforcement can be sheathed with a bonding agent before the welded seam is produced. The bonding agent can be a thermoplastic material and/or an adhesive. Sheathing with a bonding agent is preferred, if a metal wire is to be used as the reinforcement. As part of the winding process, in a preferred form of embodiment, the reinforcement can be run through a liquid or molten bonding agent; and then the sheathed reinforcement is fed continuously to the plastic strip that is being spirally wound.

[0017] In another form of embodiment of the invention, a reinforcement encapsulated in the plastic material of the plastic strip is employed. The reinforcement in this case is preferably completely sheathed by the plastic

material of the plastic strip. According to the invention, this reinforcement is provided in at least one of the mutually-facing longitudinal edge sections of the plastic strip that are to be welded together. A plastic strip with encapsulated reinforcement can be suitably produced by a suitable extrusion process.

[0018] In another preferred form of embodiment of the invention, a layer of the molten plastic filler is applied to a longitudinal strip of the plastic strip parallel to the longitudinal edge sections, and the reinforcement is applied to this layer. It is appropriate for this layer and the entire longitudinal strip to directly adjoin the layer of molten plastic-filler material introduced between the longitudinal edge sections. In this form of embodiment, the reinforcement can be made of a thermoplas tic material, preferably a plastic monofilament and/or a metal wire; and the reinforcement can be solid or hollow inside. According to the invention, the reinforcement in this form of embodiment can also be sheathed with a bonding agent. The bonding agent can consist of a thermoplastic material and/or an adhesive.

[0019] The invention is based on the realisation that spirally-wound hoses meeting all the mechanical requirements can be produced by the inventive method. Due to the inventive welded joint between the longitudinal edge sections of the plastic strip, surprisingly firm bonding of the spirally-wound plastic strip is achieved, largely excluding the possibility of the welded or bonded seams according to invention becoming torn apart, due to bending stresses and/or compressiv e stresses and/or tensile stresses, when a the finished spirally-wound hose is in use. Also the reinforcement can be particularly effectively affixed, according to invention, so that it does not come loose when subjected to mechanical stresses. This is particularly true of the form of embodiment wherein the reinforcement (preferably a metal wire) is embedded, by welding, between the overlapping longitudinal edge sections of the plastic strip. Moreover, the inventive method gives the spirally-wound hose a much smoother and more even inside surface than can be obtained with the prior-art method described initially. As a result, the quality of the spirally-wound hoses produced by the method of the present invention is considerably improved over the quality of those produced by the prior-art method.

[0020] The invention is especially advantageous in that relatively little energy - consumpti on is required to implement the inventive method. In the prior-art

method described initially, hot air has to be introduced into the interior of the spirally-wound hose in sufficient quantity, and for a sufficiently long time, to fuse the overlapping longitudinal edge sections to each other. That is relatively energy-demanding. In contrast thereto, the focused introduction of the molten plastic filler between the longitudinal edge sections only applies energy directly to the sites that are to be joined together. As a result, not only is a stronger and more effective bond produced than with the prior-art method, but also, energy-savings are achieved. Moreover, the inventive method is distinguished by its remarkably high production speed, which can be e.g. 50% higher than that of the prior-art method described initially. Another advantage of the method of the present invention is that the molten plastic filler used can be of a different colour from that of the thermoplastic material of the plastic strip. As a result, it is possible to colour-code the spirally-wound hose automatically, so to speak, as part of the inventive production method. Prior colour-coding of the plastic strips, which is expensive, is therefore no longer required.

[0021] The invention will now be explained in more detail, by way of an example illustrated diagrammatically in the drawings, in which:

[0022] Fig. 1a is a spirally-wound hose made of a thermoplastic material;

[0023] Fig. 1b is a device for performing the inventive method;

[0024] Fig. 2 is a welded joint in accordance with the invention, with reinforcing which is embedded, by welding, between the overlapping longitudinal edge sections;

[0025] Fig. 3 is another form of embodiment of the subject-matter of Fig. 2;

[0026] Fig. 4 is a welded joint in accordance with the invention, with reinforcing encapsulated in the plastic of the plastic strip;

[0027] Fig. 5 shows the subject-matter of Fig. 4 in another form of embodiment;

[0028] Fig. 6 is another form of embodiment of the subject-matter of Fig. 4;

[0029] Fig. 7 is a welded joint in accordance with the invention, with an additional layer of the molten plastic-filler material on a longitudinal strip of the plastic strip, with reinforcing applied to said layer;

[0030] Fig. 8 shows the subject-matter of Fig. 7 in another form of embodiment;

[0031] Fig. 9 shows the subject-matter of Fig. 7 in another form of embodiment;

[0032] Fig. 10 shows the subject-matter of Fig. 7 in a modified form of embodiment;

[0033] Fig. 11 shows the subject-matter of Fig. 7 in another form of embodiment; and

[0034] Fig. 12 shows a welded joint in accordance with the invention with reinforcements inlaid in the plastic strips.

[0035] Fig. 1a shows a spirally-wound hose 1 produced by the method of the present invention. A plastic strip 2 with a reinforcement running in the strip's longitudinal direction has been wound continuously in a spiral, to form the spirally-wound hose 1. The longitudinal edge sections 4, 5 of adjacent turns 6, 7 of the plastic strip 2 are bonded to one another overlappingly, as part of the inventive method. According to the invention, the longitudinal edge sections 4, 5 are welded firmly to one another by introducing a molten plastic-filler material 8 between mutually-facing longitudinal edge sections 4, 5.

[0036] The molten plastic-filler material 8 can be a different colour than the thermoplastic strip 2, thus providing "automatic" colour-coding of the spirally wound hose 1 as part of the inventive fabrication method.

[0037] Fig. 1b shows a device for performing the inventive method for fabricating a spirally-wound hose 1, in which the spirally-wound hose 1 is on a mandrel 13 constituting part of the inventive device. The plastic strip 2 is paid out continuously, and is wound spirally onto the mandrel 13. During the winding process, the spirally-wound hose 1 is being turned, and, in addition, is also being moved in the direction indicated by the unbroken arrow, due to the continuous winding that is being performed. The molten plastic-filler material 8 is produced

by means of the welding extruder 15, and is introduced between the mutually-facing longitudinal edge sections 4, 5 of the plastic strip 2, by means of an extrusion die 16. At the same time, a reinforcement 3 — which is in the form of a metal wire in the embodiment-example shown in Fig. 1b — is fed continuously, by a feeding-device 17, into the area between the overlapping longitudinal edge sections 4, 5 of the plastic strip 2, where it becomes welded in. In the embodiment-example in Fig. 1b, a pressure roller arrangement 18, which has two adjacent pressure-rollers 19, 20, can also be seen. Once the molten plastic-filler material 8 is introduced, the mutually-opposite end regions 9, 10 of the overlapping longitudinal edge sections 4, 5 are acted upon by the pressure-rollers 19, 20, to prevent unintentional escape of the molten plastic-filler material 8 from the longitudinal edge sections 4, 5.

[0038] In a preferred form of embodiment, the reinforcement 3 is introduced between the longitudinal edge sections 4, 5, and is welded in, between the overlapping longitudinal edge sections 4, 5. Such a welded joint is shown in Figs. 2 and 3, with the reinforcement 3 being a metal wire—preferably a steel wire, as is used in the embodiment-example. In the embodiment-example shown in Fig. 2, a welded joint is produced with the molten plastic filler-material 8, to efficaciously connect the longitudinal edge sections 4 and 5 and the reinforcement 3 to one another. To prevent unintended emergence of larger amounts of the molten plastic-filler material 8 from the end regions 9, 10 of the overlapping longitudinal edge sections 4, 5, these end regions 9, 10 have been subjected to pressure, as indicated by the relevant arrows in Fig. 2. This application of pressure is performed after the introduction of the molten plastic-filler material, preferably by means of pressure-rollers 19, 20 (see Fig. 1b). Preferably, the pressure rollers 19, 20 are applied with sufficiently high contact pressure. In this embodiment-example shown in Fig. 3, the reinforcement 3, which in this case is a steel wire, is sheathed in a bonding agent 11. In the embodiment example, the bonding agent can be a thermoplastic material, which surrounds the steel wire.

[0039] In the embodiment example shown in Figs. 4 to 6, a reinforcement 3 is provided that is encapsulated in the plastic material of the plastic strip 2. Preferably, this reinforcement 3 is a steel wire, as in the embodiment example. In the welded joint shown in Fig. 4, the reinforcement 3 is encapsulated in one of the overlapping longitudinal edge sections 4, 5. On the other hand, the

reinforcement 3 in the example shown in Figs. 5 and 6 is encapsulated outside of the welded joint, in the plastic material of the plastic strip 2.

[0040] Figs. 7 to 11 show a welded joint produced according to one of the forms of implementatio n of the inventive method, in which the layer of molten plastic-filler material 8 is applied sufficiently widely that the reinforcement 3 and the overlaps of the longitudinal edge sections 4, 5 can be welded in one step. The molten plastic-filler material 8 is applied to the longitudinal edge sections 4, 5 of the plastic strip 2, and the reinforcement 3 is applied to the molten layer. In the embodiment example shown in Fig. 7, the reinforcement 3 consists of thermoplastic material in solid form. This reinforcement 3 could be a thermoplas tic monofilament. In the example shown in Fig. 8, the reinforcement 3, made of thermoplastic material, is hollow inside. The advantage of this is that if the spirally-wound hose 1 gets deformed in a radial direction, the deformation will be reversible to the initial state due to elastic restoration forces. In the example shown in Fig. 9, the reinforcement 3 is made of a different material, as can be seen from the sheathing 11, which serves as a bonding agent, and which consists of a thermoplastic material in this example. Fig. 10 shows a similar reinforcement to that shown in Fig. 9. The reinforcement 3 here is preferably a steel wire with a circular cross-section. In the example shown in Fig. 11, the reinforcement is made of profiled plastic (preferably thermoplastic) material, which is hollow inside. In addition, this reinforcement 3 is sheathed with a bonding agent 11.

[0041] In the example shown in Fig. 12, the reinforcement 3 in the form of a metal wire is inlaid in the longitudinal edge sections 4", 5" of the plastic strip 2". This reinforcement 3 is not entirely surrounded by the plastic material of the plastic strip 2". When the welded joint is being made, this reinforcement 3 comes in contact with the layer of molten plastic-filler material that has been introduced between the two longitudinal edge sections 4, 5 and 4" 5", and is thus, so to speak, embedded in the welded joint.

Claims

1. A method for producing a spirally-wound hose from thermoplastic material, in which at least one plastic strip with a reinforcement is continuously wound spirally to form a spirally-wound hose, during which, longitudinal edge sections of adjacent turns of the plastic strip are bonded overlappingly to each other, **characterised in that:**
   - the longitudinal edge sections are welded firmly to each other by introducing a molten plastic-filler material between mutually-facing longitudinal edge sections;
   - the reinforcement gets affixed to the plastic strip by means of the molten plastic-filler material, and/or the reinforcement used has already been encapsulated in the plastic material of the plastic strip beforehand; and
   - after the introduction of the molten plastic filler-material, the two opposite end regions of the overlapping longitudinal edge sections are subjected to pressure by pressure rollers, to prevent the molten filler from escaping.

2. A method as claimed in claim 1, **characterised in that** the reinforcement is introduced between the longitudinal edge sections, and is welded in, between the overlapping longitudinal edge sections.

3. A method as claimed in claim 1, **characterised in that** a layer of the molten plastic-filler material is applied to a longitudinal strip of the plastic strip, parallel to the longitudinal edge sections, and the reinforcement is applied to this layer.

4. A method as claimed in any of claims 1 to 3, **characterised in that** at least one metal wire is used as the reinforcement.

5. A method as claimed in any of claims 1 to 4, **characterised in that** at least one plastic monofilament is used as the reinforcement.

5 Pages of Drawings herewith